STATE OF MAINE

DEPARTMENT OF TRANSPORTATION

TRANSPORTATION RESEARCH DIVISION
BUREAU OF PLANNING, RESEARCH & COMMUNITY SERVICES

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EXPERIMENTAL CONSTRUCTION 92-34

FIELD TRIAL OF GRAVEL STABILIZATION METHODS ROUTE 1, CYR-VAN BUREN, MAINE

4TH INTERIM REPORT

INTRODUCTION

This experimental construction project was developed, designed, and inspected by personnel from the University of Maine, Civil Engineering Staff The experimental project was constructed on and as a part of Project #2586 00 This was a complete reconstruction project 3 54 km (2 2 miles) in length The experimental section contains 6 experimental base types and is 310 m (1020 feet) in length The experimental section began at Station 1028+00 and ended at Station 1038+20 The test section consisted of 60 m (200 foot) segments of soil cement, asphalt, calcium chloride, modified, standard and one 6 m (20 foot) untreated section The stabilized and control sections were located as follows

Soil-Cement Stabilized	STA 1028+00 to 1030+00
Modified Subbase Control	STA 1030+00 to 1032+00
Asphalt Stabilized Section	STA 1032+00 to 1034+00
Untreated Section	STA 1034+00 to 1034+20
Calcium Chloride Stab Section	STA 1034+20 to 1036+20
Standard Subbase Control	STA 1036+20 to 1038+20

The Soil Cement Stabilized section is a mixture of modified subbase (mentioned later) and 6 percent by weight of type I Portland Cement

The Modified Subbase Control section is standard subbase aggregate MDOT specification 703 06b type D with a 51 mm (2") maximum aggregate size This aggregate was used on all stabilized sections to facilitate blending of each treatment

The Asphalt Stabilized section is a mixture of modified subbase and 4 5 percent of MS-4 emulsified asphalt

The Untreated section consists of modified subbase

The Calcium Chloride Stabilized section is a mixture of modified subbase and 2 8 l/m^2 (0 75 gal/yd^2) of 35 percent liquid calcium chloride solution

The Standard Subbase Control section consists of standard subbase aggregate MDOT specification 703 06b type D with a 152 mm (6") maximum aggregate size

Construction on this project started in September 1990 and was completed in the summer of 1991 A construction report "Experimental Construction 92-34" was written in December 1991 that provided a background of stabilization agents, their uses, advantages and disadvantages This report also provided preliminary design results as well as test results obtained during construction In addition to the test results a plan for long term monitoring was also included in Appendix G and reproduced for this report in Table I Some of the features to be monitored are rutting and serviceability, such as roughness and overall performance Strength measurements using a Road Rater was also suggested Most of the evaluations can be performed with the ARAN and Road Rater test vehicles Long term monitoring of the calcium chloride is specifically mentioned For this phase they recommend that test holes be bored and the base sampled every 5th year in order to monitor the possible leaching away of the calcium chloride

RESULTS

This fourth Interim report covers the period from January 1996 through December 1996 As shown in Table I, ARAN rut depth and roughness information along with Road Rater deflection data were obtained

The rut depth results are presented in Table II According to these results, the inner wheel paths are showing greater depth in both directions That is not uncommon for pavements with paved shoulders The deepest ruts range from 5 1 mm to 8 3 mm (0 200" to 0 325") and are located in the northbound inner wheel path The calcium chloride section is showing the lowest amount of rutting, whereas the soil cement is producing the highest The relatively high rut depth on the soil cement section may indicate that the sum of the rutting may be in the asphalt pavement These same data indicate that the asphalt stabilized base is rutting similarly to the granular bases While these differences have been compared and commented on, the rut depths throughout the experimental area are normal as compared to most roads of this age

Another physical property measured was the roughness of the road These results are presented in Table III The roughness values obtained indicate that all sections are performing above the accepted criteria of 4830 mm / k (190 in / mi) This value is considered as a smooth road according to ASTM specifications Table III indicates a pattern of increasing roughness, with the exception of the soil cement section that is showing a slight improvement These International Roughness Index values (IRI) indicate that the poorest riding test section is the asphalt stabilized base

The structural conditions of the various test sections were measured with the Road Rater The results presented in Table IV indicate the following

- The soil-cement section is the strongest section
- The asphalt stabilized section is showing greater stability than the granular and calcium chloride sections
- The calcium chloride section has slightly less strength than the granular sections

Further interpretation of the results are as follows

- The first 2 columns, with 76 mm and 120 mm (3" and 4¾") pavement thickness, are deflection results taken during construction These will not be discussed in this report
- The "Effective Pavement Thickness" section of Table IV is based on the elastic theory Basically the deflection bowl is used to compute a subgrade modulus (this is section titled "Computed Subgrade Value") The computer program assumes a 610 mm (24") aggregate subbase The elastic theory calculates the "Effective Pavement Thickness" using the subgrade values and an assumed 610 mm

(24") base The results show the pavement behaving as though it has a thickness between 124 mm and 145 mm (4 9" and 5 7")

- The "Pavement Required" is calculated using the structural number concept with the "Computed Subgrade Values" These numbers range from less than 17 mm to 82 mm (1" to 4 07")
- The difference between the "Effective Pavement Thickness" and the "Pavement Required" is the
- "Overlay Required" values are negative That indicates no overlay is needed It can be assumed that the lower these negative values the stronger the pavement

Although the rut data indicate increased rut depths, the soil cement section has the highest stability followed by the asphalt, standard base, calcium chloride and modified sections Regardless, the various sections are performing well structurally

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Distribution B

Other Available Documents

Construction Report December 1991
1st Interim Report May 1993
2nd Interim Report February 1995
3rd Interim Report January 1996

TABLE I

TESTING SCHEDULE FOR CYR - VAN BUREN
FIELD TRIAL OF
GRAVEL STABILIZATION METHODS

YEAR	ARAN Roughness IRI	ARAN Rut	Road Rater	Elev X-sections	Elev Profile	Crack Survey	CaCl2 Leach
1991	*	*	*				
1992	*	*	*	*	*	*	
1993	*	*	*	*	*	*	
1994	*	*	*				
1995	*	*	*	*	*	*	1995
1996	*	*	*				
1997	*	*	*	*	*	*	
1998	*	*	*				
1999	*	*	*	*	*	*	
2000	*	*	*				2000
2001	*	*	*	*	*	*	
2002	*	*	*				
2003	*	*	*	*	*	*	
2004	*	*	*				
2005	*	*	*	*	*	*	2005
2006	*	*	*				

TABLE II
PHYSICAL PROPERTIES
AVERAGE RUT DEPTHS (Inches)

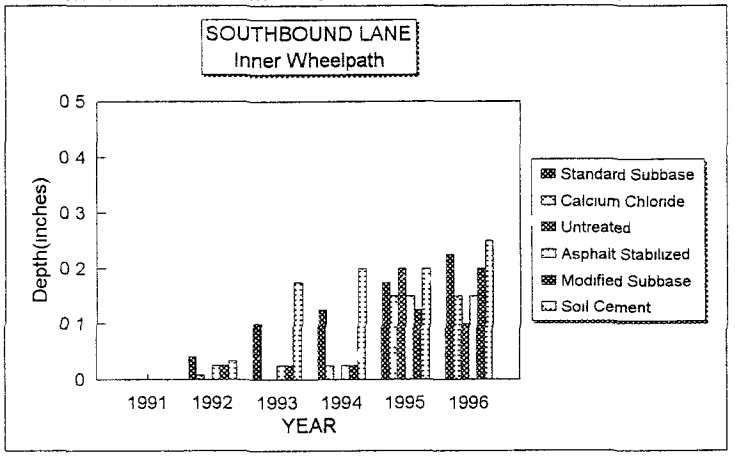
SOUTHBOUND LANE

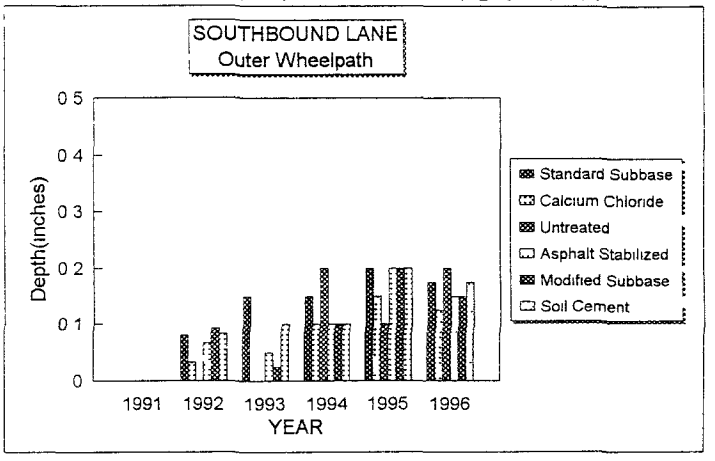
Inner Wheelpath

	1991	1992	1993	1994	1995	1996
Standard Subbase	M	0 040	0 100	0 125	0 175	0 225
Calcium Chloride	M	0 008	0 000	0 025	0 150	0 150
Untreated	M	0 000	0 000	0 000	0 200	0 100
Asphalt Stabilized	M	0 025	0 025	0 025	0 150	0 150
Modified Subbase	M	0 025	0 025	0 025	0 125	0 200
Soil Cement	M	0 033	0 175	0 200	0 200	0 250

Outer Wheelpath

	1991	1992	1993	1994	1995	1996
Standard Subbase	M	0 080	0 150	0 150	0 200	0 175
Calcium Chloride	M	0 033	0 000	0 100	0 150	0 125
Untreated	M	0 000	0 000	0 200	0 100	0 200
Asphalt Stabilized	M	0 067	0 050	0 100	0 200	0 150
Modified Subbase	M	0 092	0 025	0 100	0 200	0 150
Soil Cement	M	0 083	0 100	0 100	0 200	0 175





M represents missing data

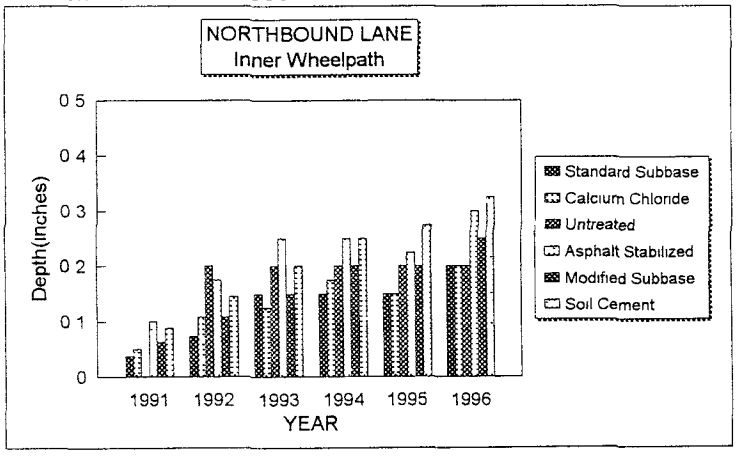
NORTHBOUND LANE

Inner Wheelpath

	1991	1992	1993	1994	1995	1996
Standard Subbase	0 038	0 073	0 150	0 150	0 150	0 200
Calcium Chloride	0 050	0 108	0 125	0 175	0 150	0 200
Untreated	0 000	0 200	0 200	0 200	0 200	0 200
Asphalt Stabilized	0 100	0 175	0 250	0 250	0 225	0 300
Modified Subbase	0 063	0 108	0 150	0 200	0 200	0 250
Soil Cement	0 088	0 145	0 200	0 250	0 275	0 325

Outer Wheelpath

	1991	1992	1993	1994	1995	1996
Standard Subbase	0 063	0 036	0 025	0 050	0 150	0 150
Calcium Chloride	0 088	0 050	0 050	0 075	0 175	0 175
Untreated	0 100	0 100	0 100	0 000	0 200	0 200
Asphalt Stabilized	0 050	0 075	0 125	0 100	0 200	0 225
Modified Subbase	0 025	0 025	0 075	0 175	0 200	0 225
Soil Cement	0 043	0 091	0 150	0 200	0 200	0 200



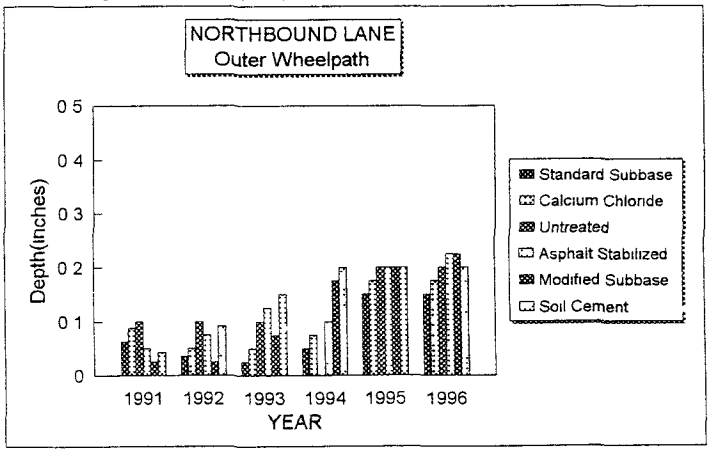
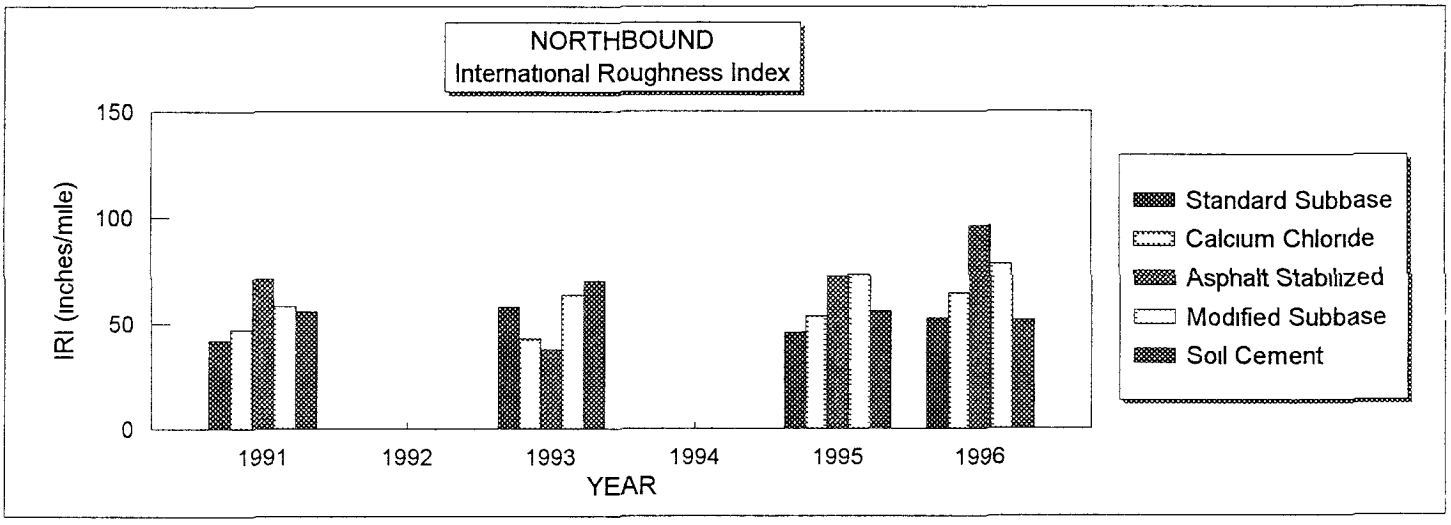


TABLE III
PHYSICAL PROPERTIES
INTERNATIONAL ROUGHNESS INDEX (Inches Per Mile)

SUBBASE TYPE	DIR	1991	1992	1993	1994	1995	1996
Standard Subbase	NBL	42 23	M	57 66	M	46 11	52 50
	SBL	M	M	M	M	40 67	50 15
Calcium Chloride	NBL	47 09	M	43 07	M	53 61	64 55
	SBL	M	M	M	M	61 35	67 24
Asphalt Stabilized	NBL	70 97	M	37 88	M	72 15	96 14
	SBL	M	M	M	M	68 22	70 49
Modified Subbase	NBL	58 09	M	63 40	M	73 09	77 89
	SBL	M	M	M	M	61 53	69 45
Soil Cement	NBL	55 67	M	69 98	M	56 03	51 65
	SBL	M	M	M	M	82 05	78 57

M represents Missing Data



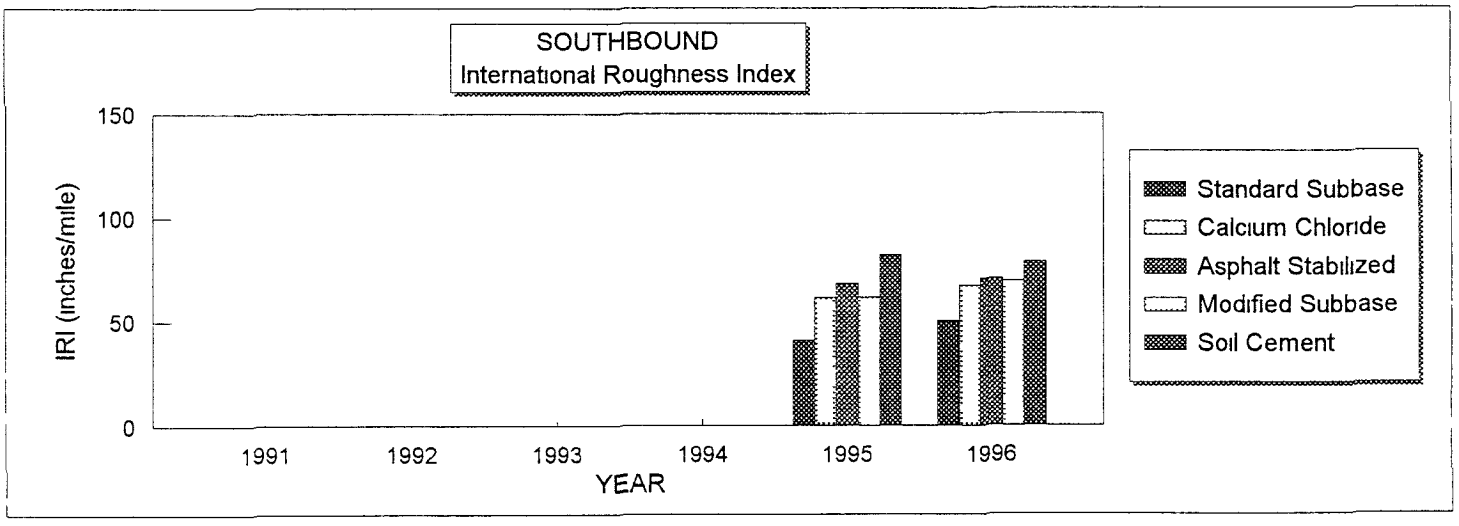


TABLE IV
CONSOLIDATED ROAD-RATER RESULTS
@ CYR PLANTATION / VAN BUREN
UMO EXPERIMENTAL BASE STUDY

Thickness Date Measured		3" 09/28/90	4 3/4" 05/21/91	6" 08/06/91	6" 09/16/92	6" 09/08/93	6" 06/14/94	6" 07/12/95	6" 09/04/96
		DEFLECTION # 1 SENSOR (MILS) (Not temperature corrected)							
Standard Subbase		4 49	3 55	2 04	1 47	1 35	1 36	1 75	1 62
Calcium Chloride		4 21	3 20	2 05	1 54	1 47	1 43	1 82	1 78
Asphalt Stabilized		4 18	2 79	1 60	1 24	1 11	1 36	1 56	1 37
Modified Subbase		4 15	3 83	2 01	1 44	1 35	1 52	1 88	1 64
Soil Cement		2 30	2 52	1 37	1 05	1 03	1 18	1 36	1 16
	**	COMPUTED SUBGRADE VALUE							
Standard Subbase		1 33	2 00	5 93	18 70	10 47	9 44	10 78	9 04
Calcium Chloride		1 86	2 68	5 84	16 68	9 78	10 99	6 42	7 53
Asphalt Stabilized		1 69	3 37	9 43	20 10	16 95	19 17	9 09	13 80
Modified Subbase		1 77	1 46	5 20	16 88	10 31	10 19	9 25	7 53
Soil Cement		8 70	4 27	15 92	20 83	30 18	22 35	16 77	21 39
	**	EFFECTIVE PAVEMENT THICKNESS (Inches)							
Standard Subbase		0 00	2 14	5 41	4 00	5 48	5 53	4 13	5 36
Calcium Chloride		0 03	2 77	5 71	4 14	5 66	4 99	4 77	5 15
Asphalt Stabilized		0 00	2 48	5 62	4 74	5 61	4 09	5 11	5 51
Modified Subbase		0 00	1 49	5 57	4 13	5 62	4 95	4 52	4 88
Soil Cement		2 41	2 96	5 42	5 49	4 95	4 65	5 56	5 68
	**	PAVEMENT REQUIRED (Inches)							
Standard Subbase		9 30	7 54	3 89	1 09	2 40	2 26	2 33	2 61
Calcium Chloride		8 51	6 56	3 93	1 48	2 78	1 91	3 35	3 23
Asphalt Stabilized		8 47	5 45	2 43	0 85	1 20	0 74	2 39	1 50
Modified Subbase		8 39	8 33	4 07	1 09	2 41	2 10	2 66	2 75
Soil Cement		2 98	4 65	1 31	0 58	0 17	0 52	1 32	0 68
	**	OVERLAY REQUIRED (Inches)							
Standard Subbase		9 30	5 40	-1 52	-2 91	-3 08	-3 27	-1 80	-2 75
Calcium Chloride		8 48	3 79	-1 78	-2 66	-2 89	-3 08	-1 42	-1 92
Asphalt Stabilized		8 47	2 97	-3 19	-3 90	-4 41	-3 35	-2 72	-4 01
Modified Subbase		8 39	6 84	-1 50	-3 03	-3 21	-2 85	-1 85	-2 14
Soil Cement		0 57	1 69	-4 11	-4 90	-4 78	-4 14	-4 24	-5 00

** Temperature corrected deflections were used in calculations